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### **Latest mass finishing technology for grinding and very fine polishing of implants**

OTEC Präzisionsfinish GmbH is one of Germany's leading manufacturers of mass finishing systems for grinding and polishing medical implants. A particular highlight of the product range is the so-called drag finishing units (see fig. 1: 2-stage DF-5 S2) which are used for grinding and very fine polishing or mirror finishing of high-quality workpieces which must not come into contact with each other during the process. Such products include cutting tools, knee implants and hip implants.



Fig. 1: 2-stage drag finishing machine type DF-5 S2

#### **The process**

In the drag finishing process, the workpieces are clamped in a holder and dragged through a grinding or polishing medium. In order to maximize the efficiency of the process, the workpiece rotates around its own axis, while moving in a planetary orbit (fig. 2). All key parameter such as workpiece rotation speed, drag speed, immersion depth, compound concentration and of course the processing time can be preselected

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on a Siemens touch panel. This ensures that the process is absolutely stable and repeatable.



Fig. 2:

In order to process the workpieces as efficiently as possible and to obtain the best possible surface finish, it is often necessary to use a 2-stage process. In this case, the workpieces are typically processed by wet grinding in the first stage and then dry polishing in the second stage. This enables, for example, workpieces made of cobalt chrome (CoCr) to be smoothed from an initial value of Ra 3.25  $\mu\text{m}$  to Ra 0.01  $\mu\text{m}$ .

By using a second drive unit, the rotation of the workpiece and the rotor can be set independently of each other. This makes it possible to define a wide variety of paths (see figs. 3 and 4).

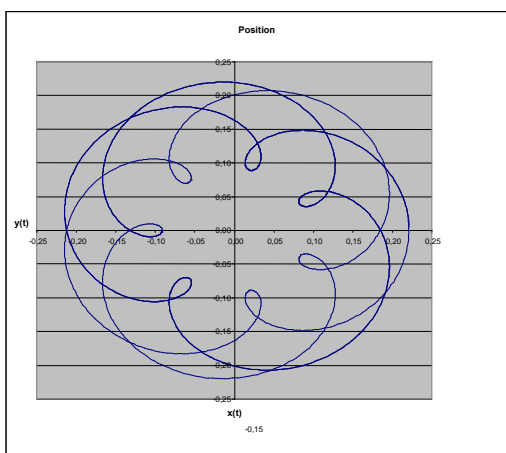


Fig. 3: Workpiece holder rotating against the direction of the rotor.

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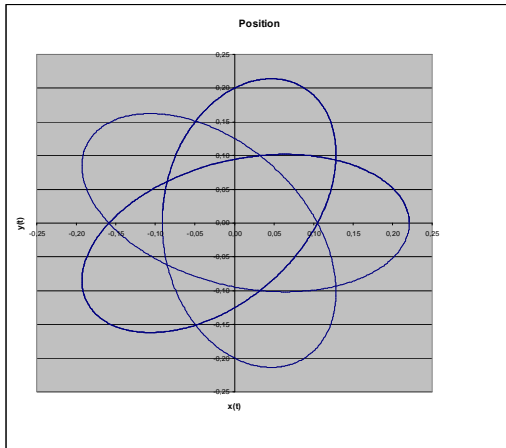


Fig. 4: Workpiece holder rotating in the same direction as the rotor.

The different speeds and accelerations that result can have a significant influence on the grinding effect of the medium, obtained simply by the selection of speed and direction of rotation.

### Advantages of the OTEC drag finishing units:

- 1. The workpiece can be changed at the touch of a button**



Fig. 5: Changing the workpiece in the independently rotating holder

A new chuck system (patent pending) enables the workpiece to be changed at the touch of a button (see fig. 5). A hex fitting is used to transfer the torque. In order to

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fit the workpiece holder in place, it is simply inserted into the socket and locks in place automatically. It can be removed at the touch of a button.

### **2. A more uniform finish is obtained by means of an angled and independently rotating workpiece holder (Patent pending)**



Fig. 6: The holder is set at an angle; each workpiece rotates independently.

OTEC drag finishing units make it possible to work with independently rotating holders. In this process, each workpiece additionally rotates on its own axis. Furthermore, the holder can be set at an angle, which in particular produces a much better finish on the front surface and inside of workpieces. This results in numerous advantages, such as:

- a better finish at the ball center of hip joint balls
- a more uniform finishing of femorals
- better finishing of the femoral box
- ideal finishing of the front face of tibias

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Fig. 7: Angled, independently rotating workpiece holder with tibia

### 3. Cover for femorals

From a point of view of work flow, it makes sense to sandblast the reverse side of femorals before grinding and polishing. In order to avoid any adverse changes to the sandblasted surface during the grinding and polishing process, OTEC has developed a special cover (see fig. 8), which also serves to fix the holder in place. This also eliminates the time-consuming process of masking the workpieces which is necessary if sandblasting is carried out later.

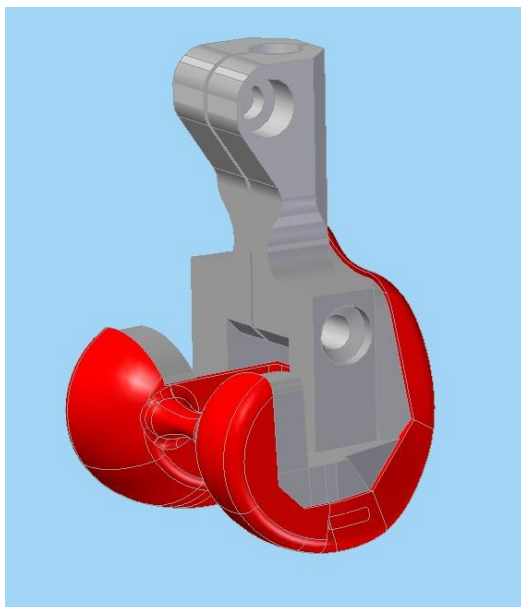


Fig. 8: Femorals with cover

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### 4. Flexible media container bottom for high quality surface finishing



Fig. 9: Flexible drum bottom

As a result of static pressure, the intensity of the finishing process is proportional to the immersion depth. This means that greater finishing forces apply nearer to the bottom of the media container – with consequently shorter finishing times. As a rule, the bottom of the media container is hard and rigid in construction. When grinding implants, ceramic or plastic bonded grinding media are used, which can easily be ground down by the rotary motion of the workpieces and the hard bottom of the media container. When a flexible bottom is used (patent pending), this simply can not happen, because the bottom itself yields to increasing pressure. This prevents the surface of the workpieces from being struck and avoids any selective compacting of the surface. This gives the best possible preparation for the subsequent polishing stage, since there is absolutely no risk of pimples or orange skin effects.

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### 5. Blasting system after wet grinding process



Fig. 10: Blasting system

OTEC has developed a blasting device to prevent any abrasive media from being carried over into the polishing process. In this process, the workpiece holder travels to a given position where it is blasted clean for a predefinable time. This reliably prevents any abrasive media from being transferred to the polishing stage.

A good product results from the interaction of a variety of individual details. And it is precisely here that the advantages of the OTEC machines come into their own. A combination of many tiny, practical details gives rise to the best possible product, which can be customized to the specific needs of the customer. The result is consistently reliable, perfect surfaces of the highest quality. Taken together, all these various components ensure that OTEC offers the best possible results for the surface finishing of implants.

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